EARTHQUAKES, TREES AND THE 'NEW NORMAL'

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

1 BACKGROUND

In the early morning hours of 4 September 2010, the city of Christchurch, New Zealand experienced a magnitude 7.1 earthquake. Since that first earthquake, Christchurch has experienced a further 7000 aftershocks, including a devastating 6.3 magnitude on 22 February, 2011, and a double impact of a 5.7 followed one hour later by a 6.3 magnitude earthquake on 13 June 2011. The state of the city has been characterised as the 'new normal'.


Image 1


Image 2


Image 3


Image 4

Photo credits: (1,2) Jonathan Hansen & (3) Tim Easterbrook

2 EARTHQUAKE EFFECT ON TREES

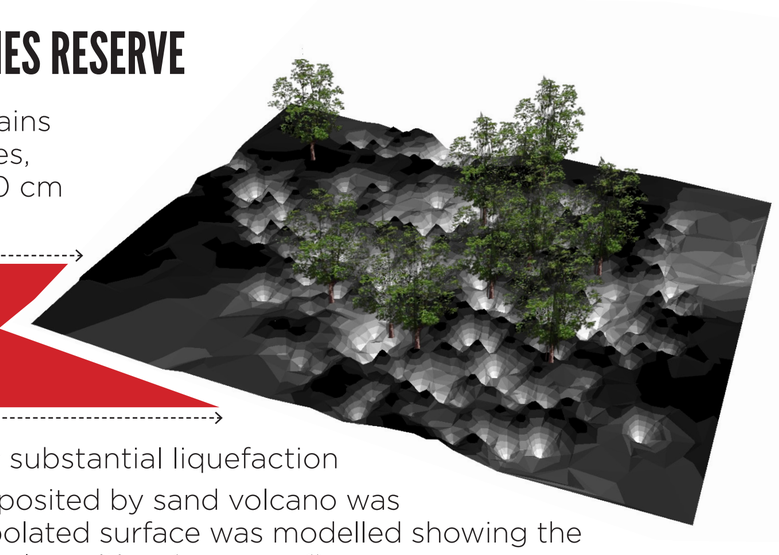
- Damage to trees was substantial. Many trees were deemed unsafe and were removed, while hundreds more are being monitored by Christchurch City Council.
- Some damage was direct and highly visible, (image 3) while other issues are likely to manifest from wide-spread liquefaction
- Direct damage includes: Limb/stem snapping due to violent shaking; and damage to structural roots resulting in leaning trees and tipups (image 1,2)
- Indirect damage is related to liquefaction (image 4)

3 WHAT IS LIQUEFACTION?

- During violent shaking, sandy soil particles realign and settle in a more compacted manner, reducing the pore volume
- This subsidence squeezes water out of pores and upwards towards the soil surface
- Sand volcanoes eject sand upwards, where it is deposited onto the surface (image 4)
- The resulting soil profile is stratified comprising a settled, compacted lower layer and a loose upper layer
- Changes in soil properties may affect hydrology, aeration, and soil chemistry
- Effects on root development and function are likely

4 A CASE STUDY: MCHAFFIES RESERVE

- This small reserve contains 13 large Eucalyptus trees, ranging in DBH from 50 cm to 175 cm



MAP 1.
Shading represents the depth of sand deposited on soil surface by sand volcanoes.
Black: 0cm → white: 45cm

- Site is characterised by substantial liquefaction
- Depth of loose sand deposited by sand volcano was measured and an interpolated surface was modelled showing the extent and depth of the deposition (see map 1).
- In some areas, 45cm of loose sand was deposited over the subsided original grade (image 4)
- How will the Eucalyptus trees respond to the drastically modified soil environment?

5 WHAT'S NEXT?

- Christchurch City Council staff continue to monitor trees
- University of Canterbury hopes to continue forming collaborations with other research institutions to fully understand earthquake effects on trees

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